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SPECIES COMPOSITION IN A GUILD OF OVERWINTERING *RHYACIONIA* SPP. (LEPIDOPTERA: TORTRICIDAE, OLETHREUTINAE) POPULATIONS IN MARYLAND

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Abstract.—A survey was conducted to determine the species composition of *Rhyacionia* populations in Maryland. Three species were detected: *R. frustrana, R. buoliana,* and *R. rigidana.* A total of 75 hymenopterous parasitoids from the families Bethylidae, Braconidae, Chalcididae, Eurytomidae, Ichneumonidae, Perilampidae, and Pteromalidae emerged from the 2368 *Rhyacionia* pupae collected. *Haltichella rhyacioniae* Gahan was the most abundant parasitoid, followed by *Eurytoma pini* Bugbee and *Campoplex frustranae* Cushman.

Larvae of *Rhyacionia* (Lepidoptera: Tortricidae, Olethreutinae) annually cause moderate to heavy damage to pines (*Pinus* spp.) in Maryland nurseries, Christmas tree plantations, and reforestation projects (Lashomb and Steinhauer, 1974). Control of these insects is difficult and results are not always satisfactory.

Powell and Miller (1978) report six species of *Rhyacionia* from Maryland: *R. adana* Heinrich, *R. aktita* Miller, *R. buoliana* (Denis and Schifflermüller), *R. busckana* Heinrich, *R. frustrana* (Comstock), and *R. rigidana* (Fernald). Many Maryland growers assume all pine tip moths in a stand are *R. frustrana.* This study was undertaken to determine the distribution and abundance of the *Rhyacionia* spp. in Maryland.

MATERIALS AND METHODS

Sites with naturally occurring and planted pines were selected in 22 Maryland counties. Samples were taken between 13 December 1979 and 28 March 1980. Table 1 summarizes host plants reported in the literature of the six *Rhyacionia* spp.

Infested pine tips were placed in plastic bags, and labelled as to host species, date, and collection site. Infested tips were collected from the lower 2 m of the tree from all sides of the host when possible. All trees surveyed were *Pinus* (*Pinus*) spp.

Tips were held at 5°C until processed. *Rhyacionia* pupae and larvae were removed from tips. Larval identifications were made using MacKay (1959). No attempt was made to rear *R. buoliana* larvae. Pupal identifications were made using Yates (1967b) and Dickerson and Kearby (1972). Pupae were placed in

Table 1. Pines occurring in Maryland which have been recorded as host plants of *Rhyacionia* spp.

	R. adana	*R. aktita*	*R. buoliana*	*R. busckana*	*R. frustrana*	*R. rigidana*
Pinus echinata					x	x
P. mugo			x			
P. nigra			x		x	x
P. pungens					x	
P. resinosa	x		x	x	x	x
P. rigida		x	x		x	x
P. strobus			x			
P. sylvestris	x		x	x	x	x
P. taeda		x	x		x	x
P. thunbergii			x		x	
P. virginiana			x		x	x

individual gelatin capsules and grouped in petri dishes according to species and collection site. The dishes were held until 1 July 1980 at 20°C for adult or parasitoid emergence. Adults were identified using Powell and Miller (1978). Parasitoids were identified using Yates (1967a).

Results

Samples were collected from 22 counties (Table 2). Surveys were conducted in all counties except Allegany. No infestations were located in Garrett Co.

Virginia pine (*Pinus virginiana* Mill) and loblolly pine (*P. taeda* L.) were the most commonly infested host species. *Rhyacionia* spp. were also collected from Japanese black pine (*P. thunbergii* Parl.), Scots pine (*P. sylvestris* L.), red pine (*P. resinosa* Ait), Austrian pine (*P. nigra* Arnold) and *Pinus taeda* × *P. rigida.*

Three *Rhyacionia* spp. were found in the survey: *R. buoliana, R. frustrana,* and *R. rigidana.* No specimens of *R. adana, R. aktita* or *R. busckana* were found.

The most abundant species collected was *R. frustrana,* comprising 92% of all tip moths collected. This species was found in all counties collected and specimens were taken from all *Pinus* spp. surveyed. The percentage of *R. frustrana* detected ranged from 76% in Worcester county to 100% in Calvert, Charles, and Washington counties.

The second most abundant species was *R. buoliana,* comprising 4% of all tip moths collected. This species was found in all counties except Calvert, Charles, Garrett, and Washington. The percentage of *R. buoliana* detected ranged from 0% in 4 counties to 11% in Wicomico county. Specimens were collected from *P. virginiana, P. thunbergii,* and *P. taeda.*

The third species found was *R. rigidana,* comprising 4% of all tip moths collected. This species was found in all counties except Calvert, Carroll, Charles, Frederick, Garrett, Howard, Montgomery, and Washington. The percentage of *R. rigidana* detected ranged from 0% in 8 counties to 21% in Worcester County. Specimens were collected from *P. virginiana, P. thunbergii, P. taeda,* and *P. nigra.*

Of the 114 samples, 57 contained only *R. frustrana,* 5 only *R. buoliana,* and 2 only *R. rigidana.* Mixed populations were found in 47 samples. Of the mixed samples, 18 contained *R. frustrana* and *R. buoliana,* 15 contained *R. frustrana* and *R. rigidana,* 2 contained *R. buoliana* and *R. rigidana,* 12 contained all three

Table 2. Distribution and Composition of *Rhyacionia* spp. in Maryland.

County	# Samples	No. *R. frustrana*	% Pop.	No. *R. rigidana*	% Pop.	No. *R. buoliana*	% Pop.	Total
Anne Arundel	7	95	81	15	13	7	6	117
Baltimore	7	145	97	1	1	3	2	149
Calvert	3	51	100	—	—	—	—	51
Caroline	4	85	93	1	1	5	5	91
Carroll	3	41	98	—	—	1	2	42
Cecil	7	133	98	1	1	1	1	135
Charles	6	95	100	—	—	—	—	95
Dorchester	6	130	88	15	10	3	2	148
Frederick	4	113	95	—	—	6	5	119
Garrett	0	—	—	—	—	—	—	0
Harford	7	110	95	1	1	5	4	116
Howard	6	67	91	—	—	7	9	74
Kent	4	116	97	1	1	2	2	119
Montgomery	4	72	96	—	—	3	4	75
Prince Georges	12	140	99	1	1	1	1	142
Queen Annes	5	164	94	2	1	9	5	175
St. Marys	4	94	98	1	1	1	1	96
Somerset	4	66	90	1	1	6	8	73
Talbot	6	233	90	6	2	18	7	247
Washington	2	50	100	—	—	—	—	50
Wicomico	5	175	83	13	6	23	11	211
Worcester	8	112	76	31	21	4	3	147
Total	114	2277	92	91	4	105	4	2473

species, and 3 contained no *Rhyacionia*. *R. frustrana* was the predominate species when present with the exception of one sample in which *R. frustrana* and *R. buoliana* were present in equal numbers.

A total of 75 hymenopterous parasitoids emerged from the *Rhyacionia* pupae. The parasitoids were: Bethylidae—1 *Gonizus columbainus* Ashmead; Braconidae—1 *Bracon gemmaecola* (Cushman); Chalcididae—16 *Haltichella rhyacioniae* Gahan; Eurytomidae—15 *Eurytoma pini* Bugbee; Ichneumonidae—1 *Atrometus clavipes* (Davis), 14 *Campoplex frustranae* Cushman, 3 *Glypta varipes* Cushman, 1 *Itoplecus quadricingulata* Privancher, and 11 unidentified; Perilampidae—2 *Perilampus hyalinus* Say; Pteromalidae—1 *Dibrachys* sp. and 9 *Habrocytus* sp. All parasitoids emerged from *R. frustrana* except 1 *E. pini* which emerged from *R. rigidana*.

Discussion

From the results of this survey *R. frustrana* is the most abundant and widespread pine tip moth in Maryland. The 46 samples (40%) with mixed populations are slightly lower but similar to the results of Miller and Yates (1964) (45% mixed) and Baer and Berisford (1975) (50% mixed). Information on species composition of tip moth population directly affects the timing of their control. Berisford (1974) and Canalos and Berisford (1981) found that the overwintering populations of *R. frustrana* and *R. rigidana* emerged simultaneously. The second generation of *R.*

rigidana emerged about 20 days later than that of *R. frustrana* (Berisford (1974), Canalos and Berisford (1981)). *R. buoliana* emerges in June in Maryland (Powell and Miller (1978)) while the other species emerge in the spring and again in the summer (Berisford (1974)).

The distribution of *R. buoliana* found by the survey was not expected. Powell and Miller (1978) record *R. buoliana* only from the northern part of Maryland. The results of this survey show the highest populations on the lower eastern shore extending the range of *R. buoliana* about 80 km south to the Virginia border.

The failure of this survey to find *R. adana, R. aktita,* and *R. busckana* was unexpected also. Of the recorded host species endemic to Maryland the only one not sampled was *P. rigida.* This indicates the above species are not common in Maryland.

The low number of parasitoids recovered was surprising. Lewis et al. (1970) found parasitism to be 12% in the overwintering pupae and Harmon (1972) found 4% parasitism for both generations. Our data showed 3% parasitism of the overwintering population. Fox and King (1963) found that parasitoids are more active in the terminal whorl of branches. On larger trees this could be a source of error in percent parasitism. The mean height of surveyed trees was 2.3 ± 1.9 m. Since the terminal whorl of branches was able to be sampled the likelihood of this sampling error was reduced.

The most numerous parasitoid in this study was *Haltichella rhyacioniae.* Lewis et al. (1970) found *Campoplex frustranae* the most abundant parasitoid. Lashomb et al. (1980) found *Lixophaga mediocris* Aldrich (Diptera: Tachinidae) to be the most numerous parasitoid during the growing season. *L. mediocris* was not detected in this survey since it overwinters as an adult (Lashomb and Steinhauer, 1982).

In our study *Eurytoma pini* was the second most abundant parasitoid. Lashomb et al. (1980) found this species to be third in abundance and Harman (1972) found this species to be second in abundance. The results are similar for *Campoplex frustranae.* Lashomb et al. (1980) found this species to be second in abundance and Harman (1972) found it to be third in abundance.

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